

## 1. Title of the Invention

Liquid Crystal Display Device

## 2. Claim

A liquid crystal display device comprising:

two transparent substrates;

a transparent electrode and a perpendicular alignment layer formed at least on a predetermined surface of each of said substrates,

a seal material for sealing said substrates, which are spaced apart by a certain space and said predetermined surface of which are opposed to each other, at peripheral portions thereof to define a container; and

a liquid crystal filled into the container,

wherein said perpendicular alignment layer is formed from a perpendicular alignment agent having a chemical structure such that a linear hydrocarbon group of  $C_nH_{2n+1}$ , where  $n$  is 15-20, is located at one end thereof and an alkoxy silane group of  $Si(OC_mH_{m+1})_3$ , where  $m$  is 1-2, is located at the other end and

said seal material contains a silane coupling agent having a chemical structure such that a linear hydrocarbon group of  $C_{n'}H_{n'+1}$ , where  $n'$  is 1-5, is located at one end thereof and an alkoxy silane group of  $Si(OC_{m'}H_{m'+1})_3$ , where  $m'$  is 1-2, is located at the other end.

## [Advantage of the Invention]

As stated above, according to the invention, two substrate each having a perpendicular alignment layer formed thereon from ODSE, etc. are spaced apart by a predetermined space and opposed to each other and the peripheral portions thereof are sealed with an epoxy adhesive enriched with a silane coupling agent such as N-methyl-3-aminopropyl triethoxy silane to define a cell. As a result, a linear hydrocarbon group with a larger number of carbons in a perpendicular alignment layer, which exhibits hydrophobicity, and a linear hydrocarbon group with a smaller number of carbons in a silane coupling agent,

which exhibits hydrophilicity, attract each other to provide a seal of excellent adhesion. Therefore, the seal may not be broken in printing the seal material and it can keep a strong adhesion even after seal curing to improve the durability of the device. Furthermore, a high stability is realized in liquid crystal molecule arrangement. In addition, a silane coupling agent added to the epoxy adhesive is less expensive and therefore liquid crystal display devices can be manufactured at low cost.

#### 4. Brief Description of the Drawing

Fig. 1 is a sectional view showing an embodiment of a liquid crystal display device according to the invention.

- 1, 2 TRANSPARENT SUBSTRATE
- 3, 4 TRANSPARENT ELECTRODE
- 5, 6 INSULATING FILM
- 7, 8 PERPENDICULAR ALIGNMENT LAYER
- 9 SEAL MATERIAL
- 10 LIQUID CRYSTAL